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THE MITES OF CITRUS TREES IN SOUTHERN CALIFORNIA

by

E. A. McGregor

Los Angeles 7, California September 19, 1956

Southern California Academy of Sciences

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E. A. McGREGOR III

Memoirs of the Southern California Academy of Sciences
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The Mites of Citrus Trees in Southern California

By E. A. McGregor

Whittier, California

Prof. H. J. Quayle (1) in 1912 discussed the mites then known to occur on citrus trees in California. His list included only 12 species at that time. In recent years the inventory of citrus mites in southern California has been expanded considerably through the collections and studies of various workers.[1] All presently known mites, together with a few unpublished species, have been incorporated into the present paper.

Perhaps the most noteworthy outcome of these studies is the revelation that by far the greater number of mites on citrus trees in southern California consists of the non-tetranychid species. Studies in recent years by Nesbitt (2), Garman (3), Cunliffe and Baker (4) and others, of the phytoseiid mites, have revealed that these predators are widely distributed, and are represented by numerous species. Many of them attack the spider mites and eriophyid mites, and are of material value in their control. As an indication of the abundance of these phytoseiids, the present paper contains 22 species, and the evidence points to the probability that more of them will be found to occur in southern California.

As Quayle stated many years ago, the spider mites collectively are, next to the scale insects, the most important pests of citrus trees. Extensive programs of control have become necessary, particularly in the case of one species.

The predaceous species constitute a hitherto rather unexplored group. Much critical study remains before their biology, ecology, and predatory potentials can be known. Such studies offer an intriguing challenge to the specialists. The treatment which follows is of the nature of a compendium for those interested in

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[1]H. C. Lewis of the Sunkist Growers, Inc., has been especially helpful in making collections, and contributing certain facts pertaining to these mites in the field. Francis Munger of the Whittier U.S.D.A. Laboratory also contributed numerous specimens.

Numbers in parenthesis refer to literature citations.

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an illustrated list of the citrus mites that have been identified to date. The family characters employed are, in the main, those used by Baker and Wharton (5) which, in turn, were adopted by these writers from Vitzthum (6).

FAMILY PARASITIDAE

Females with a pair of large, metasternal plates flanking the epigynial plate. Tarsi of all legs provided with a pretarsus, caruncle, and claws. The forked seta on the palp-tarsus has 3 tines. Dorsal plate usually divided. Leg II of males with large apophyses. Predaceous mites, aiding in destruction of mites and small insects.

Parasitus species

On orange, Rivera, Calif., June 22, 1929. No. 6-22-29, collected by H. C. Lewis; other data lacking.

FAMILY PHYTOSEIIDAE

A heterogeneous group of genera characterized by having a two-tined fork on the palpus; an entire dorsal plate; and by having the genital plate truncated or concave posteriorly.

In recent years, studies by Nesbitt (2) in Canada, and by Garman (3), Fleschner and Ricker (6-A) in the United States, have established beyond doubt that a considerable number of species of phytoseiid mites are actively predaceous on tetranychid, eriophyid, and other phytophagous species.

Lasioseius species
Plate I, figs. 1, 2, 3.

This mite was referred to Nesbitt, who replied that he could not immediately place it in its genus. With the aid of drawings, Baker identified the mite as *Lasioseius* sp., and is so listed here.

No. MG-1, Oxnard, Calif., May 15, 1953, coll. by H. C. Lewis.

Lasioseius (Zercoseius) species
Plate I, figs. 4 - 12.

A critical comparison of this mite with the preceding species revealed that they are distinct from one another in the arrangement of the dorsal setae, the shape of the sternal and genital plates, and in other particulars.

No. K-2, lemon, Corona, Calif., July 31, 1953, coll. by F. Munger, associated with citrus red mite, identified by Baker.

Garmania bulbicola (Oudemans) (7)
Plate I, figs. 13 - 16.

This appears to be the first record of an arboreal *Garmania*. Mites of this genus have been known only on bulbs, or low-lying plants.

No. McG. A-Z, Whittier, Calif., Dec. 1952, coll. by Munger, identified by Nesbitt. Under button of lemon fruits, associated with citrus red mites.

Garmania garmanis, new species
Plate I, figs. 17 - 21.

Female. – Related to *G. bulbicola;* dorsal chaetotaxy differing as figured. Setal pattern of posterior venter differing from the latter species. Peritreme reaching anteriorly to seta D-1. Anterior pair of ventral hypostomal setae not stronger than others. Oudemans' figure in Nesbitt (2) shows a pair of seta-bearing metapodal plates; Cunliffe and Baker (4) show these lacking; the present species has a pair of small, oval seta-bearing metapodals. The above authors describe prominent teeth on the hypostome, but *garmanis* has these teeth lacking or extremely inconspicuous. The anal scutum is rather oval, somewhat pointed in front, and with a small nipple laterad of each paraanal seta.

No. 11-2-54, orange, Piru, Calif., Oct. 28, 1954, collected by H. Lewis.

Garmania lewisi Garman and McGregor (8)
Plate III, figs. 7 - 9.

Collected on orange, Irvine, Calif., Aug. 16, 1954, and Aug. 21, 1954. This mite is related to, but distinct from *G. bulbicola* (Oudemans).

Typhlodromus fallacis (Garman) (3)

No. 2-11, lemon, Corona, Calif., Dec. 15, 1952, collected by Munger, identified by Garman. Regarding this mite, Garman stated that it is probably *fallacis*, but that it differs from the latter, as figured, in certain details: The dorsal body setae are noticeably shorter; a fine pore occurs near the base of each of setae L-5, L-7, and L-8; and the ventrianal plate is less narrowed posteriorly.

This mite is known to occur in Canada, and in 16 states in the United States from Connecticut to Washington and California. It has been recorded from many hosts. (*T. californicus* McGregor is also present on this slide.)

Typhlodromus cucumeris Oudemans (9)

No. B-X, on lemon, N. Whittier Heights, Nov. 15, 1952, collected by Munger. This mite occurs throughout Canada, and from Connecticut to Washington in the United States.

Typhlodromus finlandicus (Oudemans) (10)

On orange, Fillmore, Calif., Apr. 20, 1954, collected by Lewis; on lemon, El Cajon, Calif., July 30, 1941, collected by Dean

Palmer. A very common species. Cunliffe and Baker (4) report it on citrus in California, Texas, and Argentina, and on cotton in Nicaragua. Nesbitt (2) records it from all Canadian provinces, and northern United States, where it was preying on tetranychid and eriophyid mites. Fleschner and Ricker (6-A) observed this mite feeding on the citrus red mite and the citrus bud mite.

Typhlodromus pomi (Parrott) (11)
Plate II, figs. 1 - 7.

No. 9-8-54, on lemon, Corona, Calif., July 27, 1953, collected by Cox; No. 9-8-54B, on orange, Irvine, Calif., Aug. 24, 1954, collected by Lewis, identified by Garman. Bumgardner collected *pomi* from So. Calif., identified by Baker. Cunliffe and Baker (4) state that this mite is a predator of tetranychids on apples in Connecticut, New York, W. Virginia, and Washington, D.C., and in eastern Canada.

Typhlodromus aberrans (Oudemans) (12)

No. 3-10-54 (other data missing). Identified by Garman.

Typhlodromus (Iphidulus) mungeri McGregor (13)

No. X-51, on lemon, Whittier, Calif., Feb. 17, 1953, collected by Munger. Evidently feeding on citrus red mite.

Typhlodromun californicus McGregor (13)

No. 11-8, lemon, Whittier and Corona, Calif., 1953, collected by Munger. Associated with citrus red mites.

Typhlodromus longipilus Nesbitt (2)

Fleschner and Ricker (6-A) reported this mite as occurring on citrus and avocado trees. They observed it feeding on *Paratetranychus coiti* McGregor and on the 2-spotted spider mite.

Typhlodromus pacificus new species
Plate II, figs. 8, 9.

This mite was included in a paper on the phytoseiid mites of the United States, by Cunliffe & Baker (4), who then assumed that Nesbitt might some day describe it. In correspondence, Baker recently thought it might be advisable for the present author to describe this mite in his paper on the citrus mites. The description which follows is substantially the same as the tentative description in Cunliffe & Baker's paper.

Female. — With 17 pairs of short dorsal setae; with 9 pairs of marginal setae, none of which is paired with a dorsal median seta. Seta L-9 with pectinations seeming to vary from barely visible to quite distinct. Dorsal reticulate pattern faint, of longitudinal markings. Anal plate about of same width as genital plate, slightly concave laterally, with four pairs of pre-anal setae and without pores. Sternal plate with lateral winglike expansions, and with two pairs of setae. A pair of metapodal plates, each bearing a seta. A seta mesad of each coxa III. Peritreme long,

reaching anteriorly past coxa I, and posteriorly ending in a blunt angle. Setae of leg IV short, of equal length except for a long seta on base of tarsus.

Type Specimen No. 10-5-54, on lemon, Corona, Calif., July 16, 1935, coll. by H. Yust. Also slides 2-3-54 and B-15. Said to be attacking red scale. Previously reported on deer brush, Wash., thimbleberry, Ore., peach, so. Calif., and on cedar, cent. Calif. Type deposited in the collection of the Los Angeles County Museum.

Typhlodromus masseei Nesbitt (2)

Flesehner and Ricker (6-A) reported this species as occurring on citrus. They did not conduct studies of its predatory activities.

Typhlodromus citri Garman and McGregor (8)
Plate III, figs. 17 - 21.

This mite, perhaps most nearly related to *T. conspicuus* (Garman), has been recorded from southern California as follows: No. 4-18-52, on lemon, N. Whittier Heights, Apr. 18, 1952; No. 4-23-54, lemon, N. Whittier Heights, May 1953; No. 9-27-53, lemon, Whittier, Sept. 27, 1953; and No. 54-2-1, lemon, Camarillo, Dec. 17, 1953.

Amblyseius similis (Koch) (15)
Plate II, figs. 10 - 17.

A mite which occurs rather commonly on citrus in southern California was considered by Nesbitt (in correspondence) to be the same as that which Cunliffe and Baker (4) call *Thphlodromus similis* (Koch), but which Nesbitt believed is an undescribed species. The present writer referred this matter to Baker who, in turn, suggested that specimens be sent to Evans in London, for his opinion. Evans replied that, when compared with European material available to him, and with Willmann's description of *similis*, he recommended publication of the above mite under *A. similis* (Koch). Nesbitt may later see fit to publish otherwise on this species.

The writer's records of this mite in southern California are as follows: No. 1-28, on orange, Irvine, Sept. 3, 1953, coll. by Munger; No. 11-13, orange, Orange County, May 24, 1953, coll. by Lewis; No. MG-2, orange, Tustin, Jan. 23, 1953, coll. by Munger; No. 8-2-54, on lemon, El Cajon, July 30, 1941; and orange, Anaheim, June 23, 1952, coll. by Bumgardner, associated with purple scale.

Amblyseius limonicus Garman and McGregor (8)
Plate III, figs. 1 - 6.

This species resembles *Typhlodromus finlandicus* (Oudemans) in the characters of the anal plate, but differs materially in other features, as outlined in the original description. It occurs commonly in southern California; the records include, Goleta, Car-

pinteria, Santa Ana and Chula Vista. It is presumably of value against the tetranychid mites.

Ameroseius californicus Garman and McGregor (8)
Plate III, figs. 10 - 16.

On citrus, near Stanton, Calif., March 31, 1952. This appears to be the first record of a mite of this genus from California.

Seiulus species

Emery Myers of the Los Angeles County Agricultural Commissioner's office has a record of *Seiulus* species on citrus, Palo Verdes, Calif., Oct. 13, 1936, identified by Ewing.

Phytoseiulus macropilis (Banks) (16)

No. 6-7-55, Smeltzer, Calif., Aug. 11, 1953, in colonies of tetranychid mites (other data lacking).

This mite is very distinctive in that lateral setae 4, 5, 6 and 8, and dorsal seta 4 are conspicuously long and pectinate; legs unusually long; anal plate with only a single pair of pre-anal setae. Cunliffe and Baker (4) may be referred to for illustrations.

Blattisocius keegani Fox (17)

Cunliffe and Baker (4) report this mite from California.

Quayle (1) mentioned a gamassid mite as being predaceous on *Tyroglyphus*, which he said occurred very generally. This might well have been a phytoseiid.

FAMILY ERIOPHYIDAE

Minute, wormlike mites; propodosoma shieldlike; hysterosoma elongate, annulate; two pairs of legs.

Phyllocoptruta oleivorus (Ashmead) (18)
Plate XI, figs. 3 - 4.

The citrus rust mite probably occurs in nearly every citrus growing area in the world, near enough to the ocean influence. It has caused damage in San Diego County, Calif., for many years, and gradually spread northward to include Orange, Ventura, and Santa Barbara Counties. Winter conditions usually bring relief from this mite. Keifer (1952) states that it has not been found in the San Joaquin or Sacramento Valleys, and that its occurrence in damaging numbers is sporadic north of Orange County.

Aceria sheldoni (Ewing) (19)
Plate XI, fig. 2.

The citrus bud mite was first found in 1937 near Santa Paula, Calif., by J. R. La Follette and Howard Sheldon. In southern California this mite occurs along the coast, never spreading far inland in serious numbers. It has not been found in the hotter central valleys. Keifer (19-A) states that it infests citrus in the Hawaiian Islands, Java, and probably in Australia, So. Africa, and Sicily.

Although the smallest of the mites on citrus, this species rates as the most important citrus eriophyid pest being chiefly damaging on lemons. Severely damaged lemon trees show stunting and clustering of the young growth, and severe leaf and fruit malformation. (For illustrations of damage to citrus, see Baker and Wharton) (5); these authors reported the bud mite being attacked by *Mediolata terminalis* (Quayle).

Vasates advens (Keifer) (20)

This eriophyid mite was first found in 1937 on lemon at Pomona, Calif. It was not again recorded until 1954, when it was found at Ventura, Calif. Little is known of its habits, but the known facts indicate that it is of little importance to date.

Paraphytoptus californicus (Hall) (21)

In the files of the Los Angeles County Agricultural Commissioner, this eriophyid is recorded as having been found on citrus at Pomona, Nov. 23, 1937. Keifer (1952) records this species only from *Artemesia* ("sage brush").

FAMILY PYEMOTIDAE

In mites of this family, the anterior dorsal shield does not project anteriorly as a roof. Leg IV of the female is similar to legs II and III. The chelicerae are stylet-like, and the palpi are small and simple.

Pyemotes (Pediculoides) ventricocus (Newport) (22)

This mite was recorded by Ebeling (23) as occurring under dead scales. It is said to be predaceous on many insects, and at times attacks man.

In a current study of a snake-fly (Raphidiidae) by R. S. Woglum and the present author, the young and eggs of the black scale (*Saissetia oleae* (Bern.)) are used as food. This scale harbors many *Pyemotes* mites, which have parasitized many of the beneficial snake-fly larvae in the laboratory.

FAMILY TARSONEMIDAE

The tarsonemids are small, shiny mites, with a segmented body, and an anterior dorsal shield which lacks a roof-like projection. Legs IV of female differ from legs II and III in that they end in an apical and a subapical whiplike hair. Most species have a clavate organ between coxae I and II.

Tarsonemus setifer Ewing (24)

Plate IV, figs. 1, 2.

For years this mite had been known as *T. bakeri* Ewing. Beer (25) revised the Tarsonemidae of the Western Hemisphere, and synonymized *bakeri* with *setifer*. Beer believes *setifer* may be the commonest tarsonemid species.

This mite is one of the very smallest arthropod invaders of citrus trees, and is of very widespread occurrence. Beer reared it on fungus cultures, and he states that many species of *Tarsone-*

mus are fungivorus. The present author has observed *setifer* mites in colonies of *Alternaria* fungus on citrus, but has also observed it in entirely uncontaminated situations. Citrus lesions have often been seen associated with this tarsonemid. Beer records *T. setifer* from Washington and northern and southern California. McGregor (26) published on the distribution, symptoms, etc., of this mite.

Quayle (1) listed *Tarsonemus approximatus* Banks among the mites known to inhabit citrus trees. Since the tarsonemid systematics were not well determined in Quayle's time, the accuracy of the record of *approximatus* is open to question.

FAMILY BDELLIDAE

Medium-sized to large mites, possessing a sharp rostrum, hence snout-mites. Dorsum with a transverse suture. Four pseudostigmata with sensory setae, and two pairs of separated eyes on propodosoma. Usually the palpi are "elbowed" at the genu and tibia.

Spinibdella californica new species
Plate IV, figs. 3 - 5.

Widely bottle-shaped from above, with a transverse suture between the propodosoma and hysterosoma. Rostrum narrow, elongate. Four long pseudostigmatic hairs, and two shorter hairs present on propodosoma, with a pair of separated eyes each side marginally. Hysterosoma with a transverse series of 4 setae anteriorly; a seta over each coxa IV; three pairs of setae on hind third of this region; four small setae caudally. Palpus with only four movable segments (either the genu or tibia is lacking); palp-tarsus long and thin. Median member of rostrum terminally with a fringe of 12 fine spines, the middle 10 arising from angular tubercles. Tarsi with two claws and a pulvillus.

On lemon, N. Whittier Heights, Calif., Nov. 11, 1952, collected by Munger. Identification to genus was made in 1952 (through Nesbitt) by European acarologists whose names are not known. The whereabouts of the slide-mount of this species is not known. Nesbitt may have it.

Spinibdella species

No. 8-10-35, lemon, Corona, Calif., Aug. 10, 1935, collected by H. Yust. This mite was feeding on a nymph of the citrus thrips; later it fed readily on red scale crawlers. Baker identified this mite for the author as "possibly S. *utilis* (Banks)."

Scirus longirostris (Hermann) (27)
Plate IV, figs. 6 - 9

No. MG-100, on orange, El Toro, Calif., May 16, 1939, collected by Chas. Henderson; also No. 1880, orange, Tustin, Calif., May 29, 1953, collected by H. Lewis, who stated that he observed

this mite devouring flower thrips. The above mite was identified by different authorities as *Scirus, Bdellodes,* and *Cunax,* respectively.

Bdella species

In the files of the Orange Couuty Agricultural Commissioner, Anaheim, Calif., is a record of *Bdella* sp., on orange, Fullerton, Calif., June 14, 1948, identified by Keifer.

Paul De Bach reported a species of *Bdella* as occurring commonly on orange in Orange County. It is said to be predaceous on collembolids.

Bdella utilis Banks (28)

Ebeling (23) records the above species as predaceous on citrus trees.

FAMILY TYDEIDAE

Very small mites, usually ovate, skin soft with punctate striations. Body setae few, a pair of sensory setae on the propodosoma; the latter region usually separated from the hysterosoma by a suture. A dagger-like movable chela is borne anterioventrally from the chelicerae.

Tydeus californicus (Banks)
Plate IV, figs. 10 - 13.

This is the mite known for many years as *Tetranychoides californicus* Banks (29). It is extremely common on citrus throughout southern California, often living in dense groups, chiefly on the underside of leaves, their cast skins arranged in compact masses.

The mite is pear-shaped, very small, the dorsum is finely striated throughout, these mostly transverse behind coxae II, mostly longitudinal on propodosoma. A transverse suture was not seen in our specimens. A simple sensory seta over coxa I, other body setae noticeably pectinate. A fringe of 6 clavate setae along caudal margin. No eyes present. All tarsi bearing two claws and a median pulvillus.

This mite has been reported as being predaceous on the citrus bud mite (*Aceria sheldoni* (Ewing)). (Drawings are from specimens No. 3-9-54, lemon, Carpinteria, Calif., Mar. 9, 1954, collected by Lewis, identified by Baker.)

Lorryia bakeri new species
Plate V, figs. 1 - 4.

Baker examined specimens of this mite and stated in correspondence that it is near *L. ferulus* Baker, differing in having much longer dorsal setae, probably new.

This is a very small, pale, oval, soft-skinned mite. Body setae few, relatively short; a pair of sensory setae is borne on the propodosoma. Legs I-II well separated from legs III-IV; tarsi have two claws and a pectinate pulvillus. Third segment

of palpi thick; palp-tarsus cylindrical, bearing 5 setae terminally, and one seta subterminally. The chelicerae are thick; the dagger-like, under-swung chela, mentioned by Baker and Wharton (5), was not seen on the fixed chela of our specimens.

The illustrations were made from the type slide No. 3-17-55, from orange, Tustin, Calif., Aug. 25, 1953, associated with purple scale, collected by Bumgardner. Also from orange, Piru, Calif., Dec. 1, 1954, collected by Lewis; from lemon, Montecito, Calif., May 11, 1955, collected by Lewis. Found at times in spider mite colonies, but does not appear to be of great economic importance.

Pronematus ubiquitus (McGregor)
Text fig. 1

This mite originally was described by McGregor (30) under the genus *Tydeus*. Various species in this genus have, in the past, been credited with being predaceous on scale insects and their eggs. Studies of this species by the writer in central California led to the conclusion, at that time, that it probably feeds chiefly on dead insects and on lifeless eggs. It is claimed by some to feed on the fig mite. *P. ubiquitus* is one of the most wide-spread arthropods on citrus in California, often occurring in small, dense colonies. The egg of *ubiquitus* is borne on a filamentous stalk, often attached to, or near, dead or living scales.

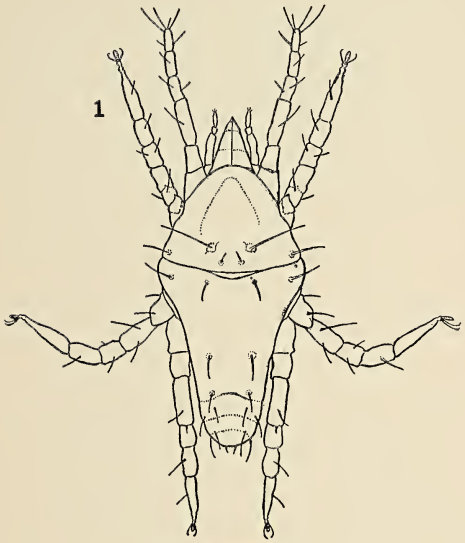
FAMILY RAPHIGNATHIDAE

No distinct suture between the propodosoma and hysterosoma. May or may not have various numbers of shields. One or two pairs of eyes may be present. The cylindrical palp-tarsus is attached ventrally on the palp-tibia beneath a prominent tibial claw. All tarsi have 2 claws and a rayed pulvillus. Most species are predaceous.

Mediolata terminalis (Quayle) (1)
Plate V, figs. 5 - 9.

This mite occurs rather commonly on citrus. It is red in color, and pear-shaped from above. Baker and Wharton (5) record it preying on the citrus bud-mite, but it is not known to be of great economic value.

Drawings were made from No. 1898, citrus, Santa Ana, Calif., July 31, 1939, collected by C. Henderson, identified by Baker. Also on lemon, Goleta, Calif., May 27, 1935, collected by G. Woodhams; on citrus, Costa Mesa, Calif., Sept. 4, 1940, associated with the 6-spotted mite; on citrus, Carpinteria, Calif., Mar. 20, 1941, collected by Korsmeier; on lemon, Escondido, Calif., March. 25, 1942, collected by McGregor; on lemon, Oxnard, Calif., Jan. 27, 1944, collected by Buckner; on lemon, Santa Barbara, Apr. 13, 1953, collected by Lewis.



Text figure 1.

Neophyllobius lamimani McGregor (31)
Plate V, figs. 10 - 14.

This is a very small mite, body round to elliptical, with no noticeable suture. Legs long and very slender, the tarsi somewhat swollen and bear 2 claws and a pulvillus. Patella of all legs with a long, whip-like hair, reaching beyond tip of tarsus.

Type 5695, So. Calif. Acad. Sci.; paratype U.S. Nat. Mus. 1749. Originally from fig tree, Fresno, Calif. Present material

from lemon, La Habra, Calif., Aug. 30, 1951, collected by B. Broadbent. Probably of little value on citrus. Roy Pence of the University of California, however, observed a species of *Neophyllobius* feeding on Latania scale crawlers.

FAMILY TETRANYCHIDAE[1]

Soft-skin mites, without shields. No distinct transverse suture. A pair of eyes each side of propodosoma. A peritreme is present. Palp-tarsus deflexed from palp-tibia; the latter with a claw. Chelicerae fused basally into the stylophore; the movable chela in the form of a long filamentous piercing organ. Tarsi usually have claws, and tenent hairs are borne either on the empodium or on the claws. Many species spin fine webbing on the food plants.

Among the phytophagus mites, the tetranychids, often called red spiders or spider mites, are with little doubt the most important economically. Most plants at times are attacked by these mites. Some species show a degree of host preference, but many are omniverous. Large-scale control measures are necessary in many cases.

Tetranychus atlanticus McGregor (32)

Type No. 1380, U.S. Nat. Museum. This mite has been recorded from 12 states in this country; also from Belgium and Turkey. In the majority of cases it feeds on non-arboreal plants. The rare occurrences of this species on citrus appear to be the result of straggling from other plants growing under or near the trees. To date, *atlanticus* is of no economic importance on citrus.

Tetranychus bimaculatus Harvey (33)[1]

Of all the tetranychid mites of the United States, this is the species most widely distributed, and its list of food plants is extensive. It seems to exhibit a preference for non-woody plants, but has become important on deciduous fruit trees in many cases. As with *atlanticus,* the two-spotted mite is an incidental pest of citrus trees, on which its occurrence originates from a transfer from nearby alternate hosts by dispersion. This happens at times when one of the newer insecticides is applied to nearby mite-infested plants, or to citrus itself. Damage to citrus by this mite

[1]Much of the field information relating to the spider mites, and the false spider mites was furnished the writer by H. C. Lewis of the Sunkist Growers, Inc.

[1]Pritchard and Baker (35) have recently seen fit to restore the old species name *telarius* L. (36) for *bimaculatus.*

is of minor importance, but in nurseries where repeated applications of DDT have been made, rather heavy infestations have developed at times.

Eotetranychus (Tetranychus) lewisi (McGregor) (34)

Type No. 1431, U.S. Nat. Museum, orange, Corona, Calif. First collected by H. C. Lewis in 1942, when he observed it feeding on mature fruits. It also occurs on lemon trees. Feeding results in a pale stippling of the fruit surface.

The Lewis mite appears to be restricted in occurrence to southern California. It has been of minor economic importance to date, and control measures have been necessary only on oranges in Ventura County. Even here, treatment has been very limited. Locality records include: Santa Barbara, Ventura, Los Angeles, Riverside, Orange, and San Diego Counties.

Tetranychus multisetis McGregor (37)

Type No. 1893, U.S. Nat. Museum, collected Riverside, Calif., Sept. 13, 1949, by M. M. Barnes.

Rearing experiments at the University of California led to the belief that this mite is a subspecies of the two-spotted mite, rather than a species entity. The present writer is inclined to support the validity of *multisetis,* based on its morphological features, and this belief is entertained by field workers, based on gross appearance and ecological factors. Lewis, Worthy and Barnhart (37-A) described a unique type of injury at the blossom end of lemons at Oxnard and Camarillo, Calif. The injury consists of a darkened ring of scar tissue, caused by the concentrated feeding of dense colonies of this mite. The writer has identified this species from a variety of food plants in 6 counties, from Santa Barbara County to San Diego County. Lewis observed limited damage to lemons at Oxnard, Calif.

Tetranychus pacificus McGregor (38)

Type No. 22,292, U.S. Nat. Museum. This mite occurs in British Columbia, Washington, Oregon, California, Idaho, Utah, Colorado and Montana. The writer has identified it from 35 different food plants, the majority of which are trees or shrubs. It is a serious pest of tree crops in Washington, Oregon, northern and central California.

The Pacific mite has been recorded on orange and lemon trees in Los Angeles County, and on grapefruit in Riverside County.

Its occurrence on citrus is rather rare, where it probably dispersed from nearby food plants. It is of very minor importance on citrus trees.

Eotetranychus (Tetranychus) sexmaculatus (Riley) (39)

The six-spotted mite was known in Florida as early as 1885 (described in 1890), and some authentic specimens in the old U.S. Bureau of Entomology collection were collected at San Diego, July 16, 1893. Thus, it has been present in California at least 62 years, to date. The only records north of the Tehachapi Mts. are one each from grape and maple at Berkeley, Calif.

In southern California this mite is confined to the coastal areas and, although at times it can be an economic pest, generally it does not cause great concern. Near the coast a heavy infestation can develop rather rapidly, and cause serious defoliation under favorable conditions, resulting in serious damage. Such cases do not occur frequently.

Eotetranychus (Tetranychus) yumensis (McGregor) (40)

Type No. 1,111, U.S. Nat. Museum. The Yuma mite was first collected in 1934, from lemon foliage near Yuma, Ariz. It also has been recorded from Bard, Oasis, and Indio, all in Imperial County, Calif. It is reported that this mite usually is most abundant in spring, and becomes less important when temperatures reach 100°, or higher.

The Yuma mite female is of a rusty-red color; the egg, unlike most species of *Tetranychus,* bears an axial stalk. The mite feeds chiefly on the under surface of the leaves of orange, lemon, grapefruit and tangerine. It spins a large amount of webbing, blotches the leaves, and at times causes some defoliation. It has been observed also on castor bean and elm.

Metatetranychus (Paratetranychus) citri (McGregor) (41)
Plate XI, fig. 1.

The citrus red mite was first known from Florida, but has been present in California for a long time. Woodworth (1902) discussed the biology, habits, and structure of this mite. Quayle (1912) published on the biology, ecology, and economics of this species. He placed the original appearance of *citri* in California at 1890, and stated that control measures became necessary in 1900. In the early days the citrus red mite was confused with the European red mite, which led to mistaken records of its

occurrence in the San Joaquin and Sacramento Valleys. Between 1920 and 1930, this mite increased in importance, and spread northward and eastward to embrace Orange, Los Angeles, San Bernardino, and Riverside Counties, and became recognized as a major pest of citrus in this area. It is now probably the most important citrus pest in Ventura County. Until recently, it had not been found in the San Joaquin or Sacramento Valleys, and it was presumed that it could not exist in these hotter regions. It was discovered by Carmen in orange orchards near Woodlake, Tulare County, in 1948, and shortly afterwards at Hamilton City, Glenn County, and in Kern County. The citrus red mite has never been found in the Coachella or Imperial Valleys, or in Arizona. It is thought by some that this mite had occurred unnoticed in central California, but that the use of DDT, beginning in 1946, resulted in a build-up of this pest, leading to its detection.

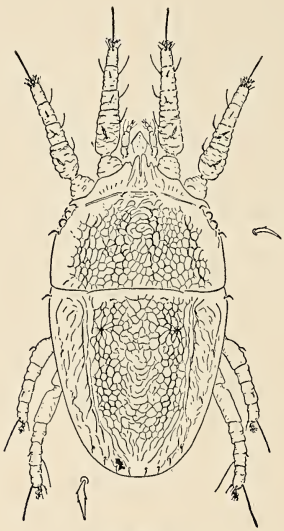
The citrus red mite feeds on the leaves, fruit, and green bark of citrus trees, causing "silvering," devitalizing, and defoliation of the trees. In the interior areas, the period of heaviest occurrence is autumn and early winter. The injury is accentuated by hot, dry winds. However, hot, dry summer weather, in time, usually reduces populations of this mite. The mite exhibits a marked preference for *Citrus* varieties, but has been found sparingly on Cotoneaster, castor bean, *Choysia, Eleagnus,* English laurel, peach, Scotch broom, walnut, and *Wistaria* in southern California.

Bryobia praetiosa Koch (42)
Plate VI, figs. 1 - 8.

This species is known as the almond mite, brown mite, or clover mite, and is about the largest of the phytophagous mites. In color, they are reddish to rusty-brown. The body above is flat, the front legs are long, and the anterior margin of the body bears 4 lobes, each with a leaflike seta. *Bryobia* has been recorded on citrus, but has never presented an economic problem on this host. The writer has recorded it from 15 different food plants, mostly annuals, in southern California. It is world-wide in occurrence.

FAMILY PHYTOPTIPALPIDAE

Small, reddish mites, often with a transverse suture dorsally; skin frequently reticulated or striated; two pairs of eyes; body setae rather inconspicuous; clelicerae needle-like, protrusible; mandibular plate present; all tarsi have 2 claws, tenent hairs, and a pulvillus. Tarsi I and II with a rodlike sensory seta.



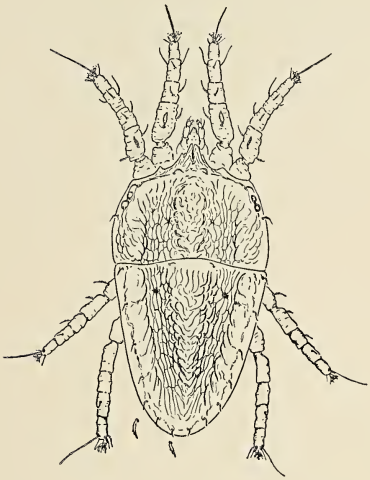
Text figure 2.

Brevipalpus australis (Tucker) (43)
Text figure 2.

This mite was first recorded from S. Africa. It was found on citrus at Santa Paula, California, in 1948. No records are known of injury to citrus in southern California.

Brevipalpus californicus (Banks) (29)

Banks described this mite from specimens collected in 1903 on orange, Redlands, Calif. It occurs at times rather abundantly on *Citrus* varieties at Redlands and Corona. On one occasion an infestation was so severe in a large Corona orchard that treatment was required. It is reported also to have been found at Santa Paula and at Azusa, Calif.



Text figure 3.

Brevipalpus lewisi McGregor (44)
Text figure 3.

Type No. 1527, U.S. Nat. Museum. H. C. Lewis originally collected this mite in 1942 on lemon at Porterville, Tulare County, Calif., and later from other points in this county. Subsequent observations by Lewis revealed its occurrence from Kern County northward to Oroville, in the Sacramento Valley. Lewis also found it in most citrus orchards in the Coachella and Imperial

Valleys, and it was found in Arizona in 1950. All *Citrus* varieties are attacked. It was often found around the "button" end of the fruit, and caused considerable injury in a lemon orchard near Porterville, consisting of scab-like scars on the upper side of the fruit. Treatment for control became necessary. In 1947 it was found attacking pomegranates, resulting in the culling of from 50% to 90% of the fruit in some orchards. To date it has not been found in southern California, with the exception of Imperial and Coachella Valleys.

This mite is carrot- to salmon-red in color and, like other mites of this genus, the proximal end of the femur of the legs is articulated to the next segment by a greatly constricted base.

Brevipalpus mcgregori Baker (45)

Baker (1949) described this species from lemon, Santa Paula, Calif. He also recorded it from Oxnard, Calif., occurring on *Brickellia californica.* There appears to be no record of economic injury.

Brevipalpus woglumi McGregor (44)

Type No. 1528, U.S. Nat. Museum, from Spring Valley, San Diego County, Oct. 20, 1943.

Pritchard and Baker (45-A) saw fit to reduce this species to synonymy with *B. californicus* (Banks), although they conceded that certain structural differences exist between these mites. The present writer conducted rearing experiments involving several generations of *californicus, lewisi,* and *woglumi.* These tests were made in Munger cells, all host and ecological factors being as nearly identical as possible. The intense scarlet color of the *woglum* mites persisted unchanged throughout the studies, while the tan to pale red of the *californicus* and *lewisi* mites also continued unchanged. When these factors, together with the structural differences, are considered, it would seem advisable to restore *woglumi* to valid specific rank.

FAMILY ANYSTIDAE

Reddish, fast moving mites with soft integument, without a transverse suture on dorsum. Rostrum short and conelike. A movable, distal, hooklike chela is present. The palp-tibia with 1 to 3 inner claws; palp-tarsus borne disto-ventrally on tibia. Legs arise radially, with coxae closely situated; tarsi with 2 claws and an empodium. Predaceous.

Amystis agilis ? Banks (45-B)
Plate V, figs. 15 - 18.

A reddish, broad ovate-triangular, very rapidly running, predaceous mite. Large, nearly 1 mm. in length, legs very hairy.

(The writer did not detect the tubercle-like projection on the anterior margin of body, included by Baker and Wharton (1952) as a family character.) This mite is suspected of having a definite predatory potential against arthropods of citrus. Nesbitt, in correspondence, wondered if this species could be *A. baccarum* L. It occurs rather commonly. The specimen from which the drawings were made (on lemon, Corona, Calif., Aug. 30, 1937) cannot now be located. However, a good specimen is on McG. slide No. 5-11-55.

Bechsteinia californica new species
Plate VII, figs. 1 - 4.

Type No. MG-B2, on lemon, Whittier, Calif., Dec. 16, 1952, collected by McGregor; also slide No. B-1.

This mite was sent to Nesbitt who, in turn, sent it to European acarologists (names unknown to the writer). The latter authorities identified it as probably a new species of *Bechsteinia*.

A reddish, fast-moving, oblong-elliptical mite. Legs long, hairy, fourth pair longest, nearly three-fourths again as long as body. Two pairs of eyes. Body setae linear, simple, 11 pairs on dorsum, numerous hairs laterally. Propodosoma apically with a dome-like boss, bearing a pair of sensory setae, and a pair of extruded peritremes. Palp-tibia bearing a strong claw; palp-tarsus exceeding claw, with numerous setae of various lengths, some pectinate. Tarsi of legs terminally with a pair of leaflike, serrate claws. (In the illustration, made from No. B-2, the many circles and dots on the legs, indicate where many hairs have been lost.)

FAMILY CHEYLETIDAE[1]

Yellowish or reddish, usually predaceous mites. Propodosoma and hysterosoma usually plainly delineated, and usually with one or more dorsal shields. Body setae from simple to scalelike. A peritreme framing the gnathosoma. Palpi large, often complex, with comblike and sicklelike setae; palp-tibia with a strong, usually toothed terminal claw. Tarsi of legs usually with 2 claws and an empodium.

Cheletogenes ornatus (Canestrini & Fanzago) (46)
Plate VII, figs. 5 - 6.

This small salmon colored mite was observed feeding on the citrus bud-mite at Santa Paula, Calif., and near San Diego; it

[1]For the taxonomy of the cheyletid mites, see the revision by Baker (1949). Proc. U. S. Nat. Museum, vol. 99(3238): 267-320.

was very common at the latter locality. It was seen attacking *Tarsonemus setifer* at Whittier; it was observed feeding on Latania scale and ivy scale in Orange County. In the files of the Orange County Agricultural Commissioner, Beyers and Bumgardner record this mite attacking purple scale on citrus at Brea, Calif. The evidence indicates that *C. ornatus* is a rather versatile predator.

Eucheyletia mungeri, new species
Plate VII, figs. 7 - 9.

A mite was sent to Baker for examination, and he replied that it is an undescribed species of *Eucheyletia,* and he suggested that it be described in this paper.

Female. — Body broadly ovate; two dorsal shields; the anterior shield largest, wider than long, bearing 4 pairs of clavate setae laterally, and a pair of scalelike setae posteriorly; the posterior shield bearing 5 pairs of clavate to scalelike setae marginally. A fringe of 8 small setae occur caudally. (Baker stated in correspondence that he could distinguish with difficulty the so-called cloud-setae on the shields, but the writer could not.) Palp-tarsus with 2 sicklelike and 2 comblike setae, and a tiny, peglike seta; outer comb fully as long as claw, with 20 teeth; inner comb smaller, with about 34 teeth. Palpal claw with 2 basal teeth. Tarsus of leg I with a rodlike sensory seta, about one-third as long as guard seta; other tarsal setae linearlanceolate, pectinate. Tibia I with 4 linear, pectinate setae, one strongly clavate-pectinate seta, and subapically a small, clavate sensory seta.

Type. — MG No. G-8. On lemon, Corona, Calif., Dec. 12, 1952, collected by Munger. Associated with citrus red mite, and red scale. Also, a cotype slide, No. 885.

Cheletomimus berlesei (Oudemans) (47)
Plate VII, figs. 10 - 13.

A small, oval to roundish mite with a short, broad gnathosoma; palp-femur short, thick, rounded externally.

On lemon, Costa Mesa, Oct. 10, 1948, collected by Bumgardner and McEachert, in citrus red mite colony. Also on lemon, Santa Paula, Sept. 1949; and on orange, Oxnard, Calif., Jan. 29, 1954, associated with *Tetranychus lewisi.* This mite is rather common in southern California, and the evidence indicates that it is predatory on tetranychid mites.

FAMILY ERYTHRAEIDAE

Reddish, predatory mites, active runners. Heteromorphic in the larval stage, and parasitic on arthropods. Adult body oval,

with many setae. A transverse furrow on dorsum. Propodosoma with a median, longitudinal crista, with two sensory areas. Coxae I-II and III-IV in two separate groups. The palp-tibia has a strong claw; palp-tarsus arises from under base of claw.

Balaustium aonidaphagus (Ebeling)
Plate VIII, figs. 1 - 5.

Ebeling (48) described this mite under the genus *Erythraeus*. He stated that it is not usually abundant, but he found as many as 30 mites on a single tree; usually only 2 or less. Ebeling observed these mites feeding on red scale in various stages, and on other small insects.

The drawings in Plate VIII were made from Ebeling's specimens on lemon tree, Riverside, Calif., May 4, 1943. The morphology of the mite, as seen by the present author, agrees in the main with that recorded by Ebeling. However, the latter shows the hairs on the palp-tarsus to be thin-linear, whereas the author found them to be brad-like. Also, as originally figured, the tarsal claw is free of hairs, but actually they are densely clothed with minute hairs. The features of the dorsal chista were not readily seen in the specimen, due to the state of preservation, and the sensillary areas were not detected. A semicircular fringe of hairs border the front pair of sensory setae anteriorly. The dorsal body setae are short, linear, simple; ventral setae are featherlike.

Balaustium species
Plate X, figs. 1, 2.

No. 9-30-54, on lemon, Corona, Oct. 2, 1936, collected by McGregor, identified by Baker as a larva of this genus.

The specimen has certain characteristics differing from those of the adult, as known. The sensory areas of the crista have no setae. The tarsus of legs has 3 claws and a median pulvillus, whereas the family diagnosis states that there are only 2 claws and no empodium.

Erythraeus species
Plate VIII, figs. 6 - 9.

No. 11-21-35, orange, Redlands, Calif., Nov. 21, 1935, collected by Woglum; also No. 1833, from which the drawings were made.

A very large, red mite, densely furnished with very short, pectinate setae on the body; leg hairs linear-lanceolate setose. Parasitic on arthropods. Mites of this genus often attach themselves, at times, to insects in large numbers.

FAMILY ACARIDAE

Body distinctly divided by a suture into a proterosoma and hysterosoma. Robust, surface usually shiny. The chelicerae are chelate. Five pairs of setae on propodosoma. A pseudostigmatic organ is present. The genital opening is between coxae III and IV.

Tyrophagus putrescentiae (Schrank) (49)
Plate VIII, figs. 10 - 12.

No. 4-7-54, on lemon, Whittier, Calif., May 30, 1945, collected by McGregor, identified by Nesbitt.

Body widely oval; propodosoma rhombic, its four posterior hairs long, the inner pair reaching beyond the base of second pair of submedian hysterosomal hairs. Hysterosoma with second pair of submedian hairs as long as this segment; the third pair of submedian hairs and the 5 pairs of posterior marginal hairs long, forming a conspicuous caudal fringe. A plumose seta borne each side, slightly under lateral margin of propodosoma, and over coxa I. All tibiae bearing a long, whiplike hair; tarsus I basally bearing a longish, rodlike sensilla, and two very small sensillae, all arising close together.

Tyrophagus cocciphilus (Banks) (50)
Plate VIII, figs. 13 - 15.

No. 4-17-54, under black scale, Carpinteria, Calif., Jan. 22, 1954, collected by Lewis, identified by Nesbitt.

This mite resembles the preceding species, but with the following differences: The propodosoma is narrower in front, with sides somewhat concave; the transverse series of 4 hairs on this segment are farther forward, and the outer pair are shorter, and distinctly sctose; the middle pair are somewhat shorter than in *putrescentiae.* The ventrolateral sensory seta over coxa I is almost simple, with scatteres serrae. The middle subbasal sensory seta on tarsus I is subequal to the other two.

Thyreophagus species
Plate IX, figs. 1, 2.

No. MG-100, under purple scale on oranges, Santa Ana, Calif., Aug. 13, 1952, collected by Bumgardner. Baker identified this mite as *T. entomophagus* Laboulbene; Garman suggested it might be an undescribed species.

A small, wormlike mite, narrowly elliptical, with a distinct suture separating the proterosoma and hysterosoma; surface smooth. Setae very scarce, a pair on anterior of propodosoma, and 4 at caudal end (seen from above); none others observed.

No eyes seen. Legs I-II widely separated from legs III-IV, all legs stubby, and with a single claw. Patella I with a simple seta and a sausage-shaped organ above distally; tibia I with a very long, whiplike hair above distally; tarsus I with a curved rodlike organ above, subbasally, and a long seta borne centrally on upper face. Mandibles strong, upper with 4 dentations, lower with 3. Palpi evidently 4-segmented; second segment much the longest; tibia with a strong claw; palp-tarsus stout, bearing a small seta terminally. These mites are alleged to be scavengers.

Tyroglyphus americanus Banks (50)

Ebeling (23) included this species in his book on subtropical entomology. The taxonomy of this, and related mites, has been somewhat confused, and it is possible that Ebeling's mite may belong in another genus. A mite thought to be the above species has been observed by Munger under the "buttons" of lemon fruits, usually in the presence of moisture. Typhlodromid mites often were associated with them.

FAMILY CZENSPINSKIIDAE

Mites with a propodosomal shield; the surface is shiny and finely striated. Of the transverse row of 4 setae on the rear of propodosoma, the inner pair are much shorter than the outer. No cervical setae are present, but with a pair of vertical setae. All tarsi have stalked claws, long caruncles with minute spines. Female genital opening lies between coxae III and IV.

Czenspinskia transversostriata (Oudemans) (51)
Plate IX, figs. 3 - 5.

No. 3-14-54, on lemon foliage and fruit, Carpinteria, Calif., March 9, 1954, collected by Lewis, identified by Nesbitt. Also on horehound, Bolsa Chica, Calif., Apr. 20, 1955, collected by Elmore. Recorded also from San Diego.

A small elliptical mite, usually with two conspicuous dark spots caudally. A swollen seta at midpoint of tarsus I dorsally. Mandibles stout, upper with 5 teeth, lower with 4. All tibiae with a long hair subterminally. Other characters as in the family diagnosis, except that caruncles are short, with no spines observed.

Little is known of the feeding habits of this mite on citrus, but *C. lordi* Nesbitt is known to be a plant feeder. Occurring very commonly in San Diego County.

FAMILY HEMISARCOPTIDAE

Body egg-shaped, skin smooth and shiny, with a propodosomal shield. Body setae few, mostly inconspicuous. Vertical setae present. Chelicerae scissor-shaped, not denticulate. Legs short and robust. Tarsi lack claws, but each has two strong, clawlike spines terminally, with a long, bradlike caruncle between them. Genital openings are far behind coxae IV. All tarsi have a long seta, that of tarsus IV the longest.

Hemisarcoptes malus (Shimer) (52)

Plate IX, figs. 6, 7.

No. MG-100, under purple scale on orange, Santa Ana, Calif., May 1953, collected by Bumbardner, identified by Baker. Also attacking Latania scale, and several other species of scale insects. Widely distributed, said to exert considerable control at times.

The characters of *H. malus* are similar, in the main, to those listed for this family. Baker and Wharton (1952) state that tarsi III and IV have a whiplike seta. In the writer's specimens, tarsi I and II also bear a rather long hair. The above specimens have a strong, sausage-shaped sensory organ on tarsus I, and 2 similar smaller sensory organs on patellae I and II. The chelicerae (under oil-immersion) are distinctly denticulate, contrary to the family diagnosis. Two long, whiplike hairs caudally.

FAMILY ANOETIDAE

Anoetus species

On orange, Mesa, Ariz. (Listed in "Mites of Arizona," Dept. Entom., Univ. Ariz.). Inserted here merely since this mite could well occur in neighboring Imperial Valley. No description available.

FAMILY CERATOZETIDAE

Oribatid mites with small pteromorphs, not projecting beyond anterior portion of opisthosoma. Inner margin of lamellae is fastened to the propodosoma, and the anterior portion projects freely. Genital plates have 6 pairs of setae.

Humerobates humeralis ? (Herman) (27)

Plate IX, figs. 8 - 12.

Associated with purple scale on orange, Orange County, Calif., July 1942, and May 24, 1953, collected by Lewis. Also with citrus red mite on lemon, Whittier, Calif., Apr. 23, 1943, collected by Munger. In correspondence, Nesbitt stated that this mite resembles *H. humeralis,* but that he could not be certain of its identity.

This mite, commonly called a beetle mite, is usually of a dark slaty color, but at times is paler. It is extremely common and widely distributed on all varieties of *Citrus.* It occurs on many parts of the trees, but perhaps more often seen within the calyx of the fruits. At times it is associated with lesions of citrus tissues, which fact, considered together with the mite's strong jaws, suggest it may cause this injury.

A mite in the oribatid group
Plate X, figs. 3 - 5.

A mite on lemon, Whittier, Calif., Apr. 23, 1943, No. 1953, collected by Munger from a citrus red mite colony, has not yet been identified. This mite also was collected from orange, Orange County, May 24, 1953, by Lewis, associated with purple scale. Figure 2 might suggest that two or more stages may be present, one within the other.

FAMILY ORIBATULIDAE

In the files of the Orange County Agricultural Commissioner, there is a record of a mite in this family, from orange, San Juan Capistrano, Calif., collected by Bumgardner, identified by Baker, with no additional data.

FAMILY GALUMNIDAE

Pterogasterina mites with large, movable, hinged, winglike pteromorphs; their rounded anterior and posterior ends project far over the line where they join the body. The lamellae are weakly developed or lacking. Each genital plate has 6 setae.

A record is on file in the office of the Orange County Agricultural Commissioner of a *Galumna* species, on orange, San Juan Capistrano, Calif., Nov. 9, 1950, collected by Bumgardner, identified by Byers. The Los Angeles County Agricultural Commissioner's office contains a record of *Galumna* species, Azusa, Calif., Nov. 10, 1937; also one at Whittier, Aug. 18, 1938; and a *Galumna* from Covina, Calif., Sept. 18, 1940 — all on citrus, all identified by Keifer.

Several mites in the above family are known to be vectors of tapeworms.

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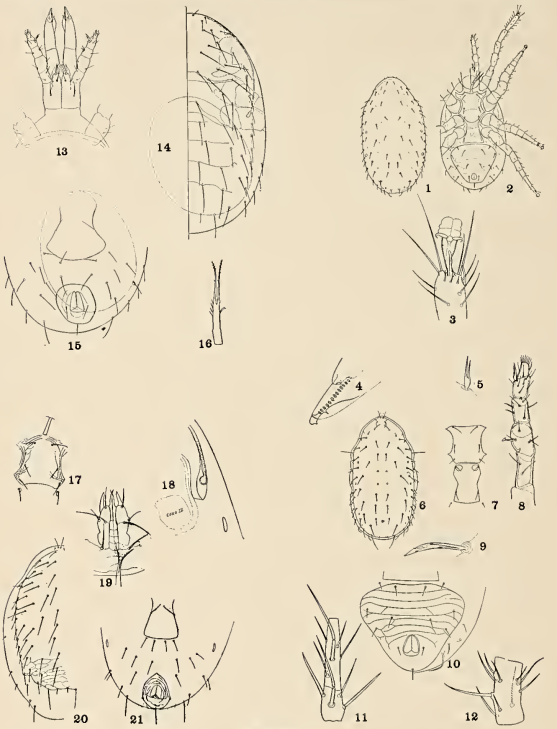

PLATE I

1-3. *Lasioseius* sp. 1, dorsum showing setal arrangement; 2; ventral view of mite; 3, tip of tarsus I.

4-12. *Lasioseius (Zercoseius)* sp. 4, lateral view of chelicera; 5, forked seta of palpus; 6, dorsum showing setal arrangement; 7, sternal and genital plates; 8, palpus; 9, a dorsal seta; 10, ventri-anal plate and associated setae; 11, basal portion of tarsus IV; 12, tibia IV.

13-16. *Garmania bulbicola* (Oudemans). 13, gnathosoma, ventral; 14, right half of dorsum; 15, ventral view of caudal portion of body, showing genital and ventri-anal scute, and associated setae; 16, tritosternum.

17-21. *Garmania garmanis* new species, female. 17, sternal scutum; 18, posterior portion of peritreme; 19, ventral view of hypostome; 20, left half of dorsum; 21, ventri-caudal region.

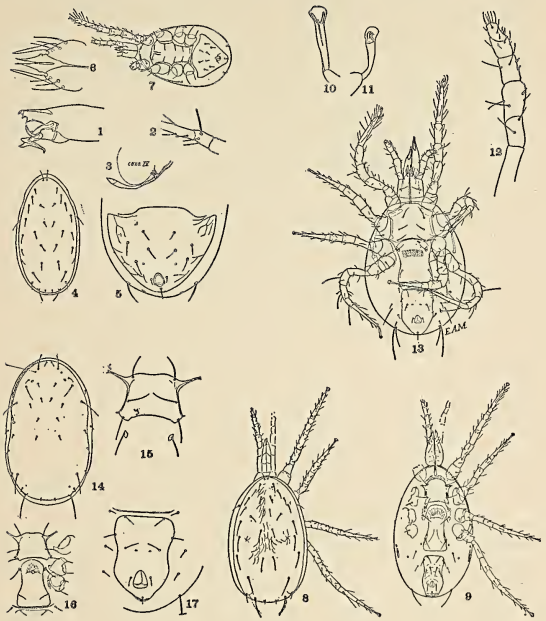

PLATE II

1-7. *Typhlodromus pomi* (Parrott). 1, lateral view of chelicerae; 2, basal portion of tarsus IV; 3, posterior portion of peritreme; 4, dorsum of male; 5, ventri-anal plate; 6, ventral view of hypostome; 7, ventral view of male.

8-9. *Typhlodromus pacificus* new species. 8, dorsal view of mite; 9, ventral view of mite.

10-17. *Amblyseius similis* (Koch), female. 10, terminal portion of tarsus, ventral; 11, same, lateral; 12, palpus; 13, female, ventral view; 14, dorsum of mite; 15, sternal and metapodal plates; 16, sternal and genital plates; 17, anal plate and associated setae.

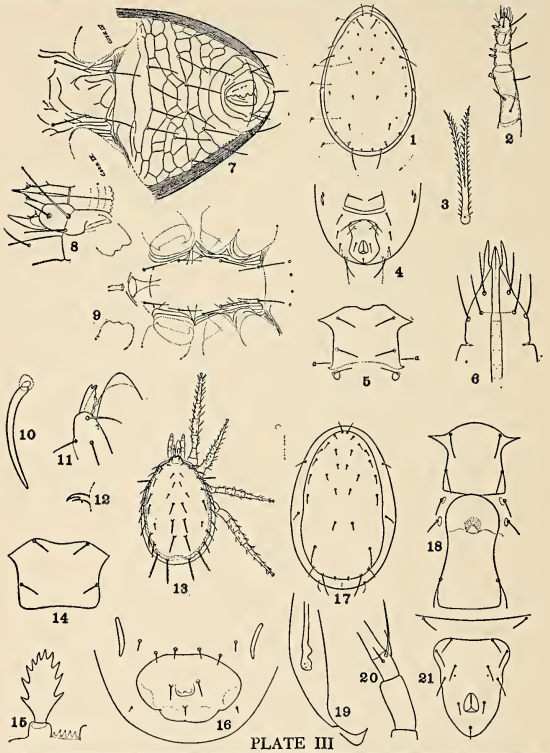

PLATE III

1-6. *Amblyseius limonicus* Garman and McGregor, female. 1, dorsum of mite; 2, palpus; 3, tritosternum; 4, posterior of venter, showing ventri-anal scutum and associated features; 5, sternal scutum and metapodal plates; 6, hypostome.

7-9. *Garmania lewisi* Garman and McGregor, male. 7, posterior venter and associated features; 8, ventral view of hypostome; 9, sternal-genital plate and coxal bases.

10-16. *Ameroseius californicus* Garman and McGregor, female. 10, seta D-5; 11, hypostome and median structure; 12, forked seta on palp-tarsus; 13, dorsal view of mite; 14, sternal plate; 15, left leaflike seta at front of body; 16, posterior venter, showing ventri-anal scutum, parapodal plates, and associated setae.

17-21. *Typhlodromus citri* Garman and McGregor, female. 17, dorsum of mite; 18, sternal and genital plates; 19, posterior portion of peritreme; 20, tibia and basal part of tarsus IV; 21, ventri-anal plate.

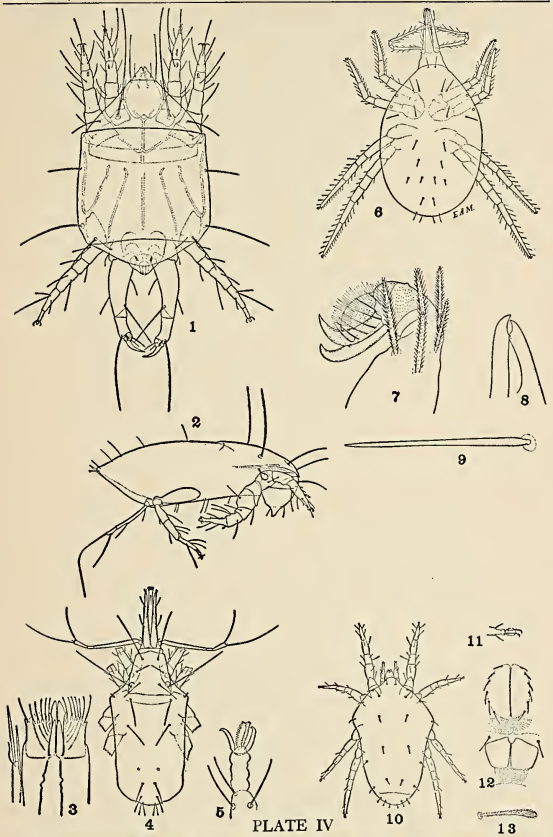

PLATE IV

1-2. *Tarsonemus setifer* Ewing. 1, dorsal view of male; 2, lateral view of female.

3-5. *Spinibdella californica* new species. 3, rostrum, showing fringe of 12 spines; 4, dorsal view of mite (only bases of legs shown; humeral setae appear to be broken off near base); 5, tip of tarsus.

6-9. *Scirus longirostris* (Hermann). 6, dorsal view of mite; 7, tip of tarsus; 8, lateral view of chelicerae; 9, a dorsal seta.

10-13. *Tydeus californicus* (Banks). 10, dorsal view of mite; 11, tip of tarsus; 12, posterior ventral plates; 13, one of clavate setae on caudal margin of body.

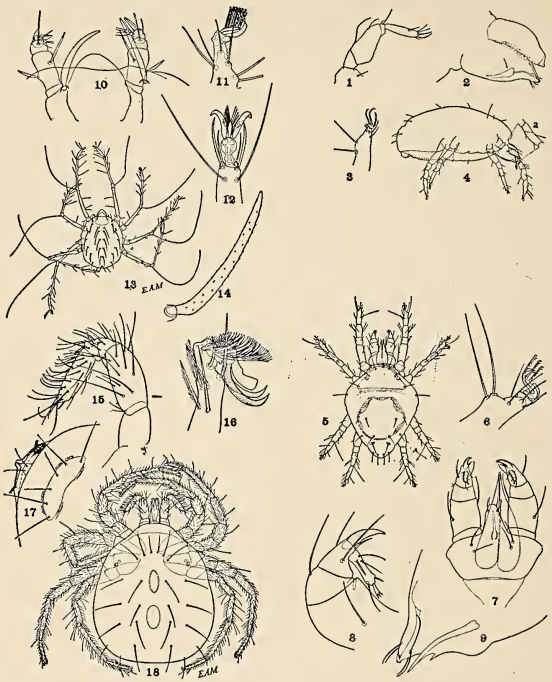

PLATE V

1-4. *Lorryia bakeri* new species. 1, lateral view of palpus; 2, lateral view of gnathosoma; 3, tip of tarsus; 4, lateral view of mite ("a", excised portion of leg I).

5-9. *Mediolata terminalis* (Quayle). 5, dorsal view of mite; 6, tip of tarsus I; 7, ventral view of gnathosoma; 8, lateral view of palpus; 9, lateral view of hypostome.

10-14. *Neophyllobius lamimani* McGrego. 10, anterior portion of body, with palpi, mandibular plate, and overlying setae; 11, tip of tarsus, lateral view; 12, tip of tarsus, dorsal; 13, dorsal view of mite; 14, dorsal body seta.

15-18. *Anystis agilis* Banks. 15, palpus; 16, tip of tarsus I, showing claws, pulvillus, and branched seta; 17, front of body showing row of 6 body setae, apical tubercle bearing 2 tactile hairs, and marginal peritremes, partly extruding; 18, dorsal view of mite.

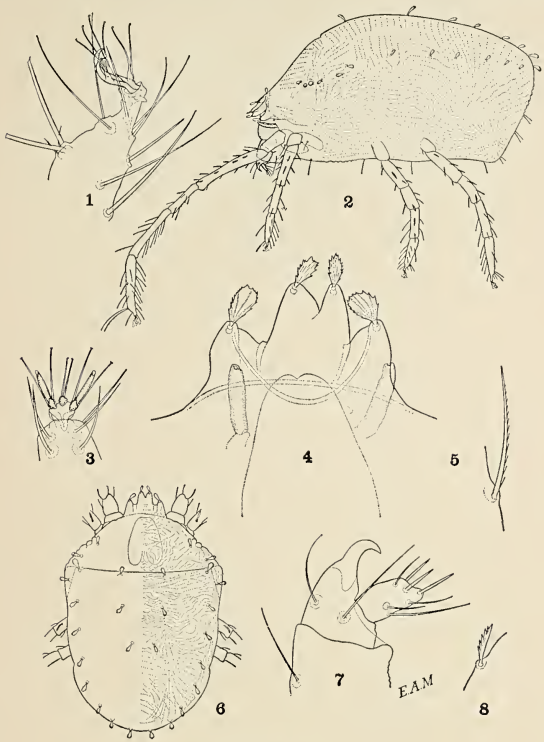

PLATE VI

1-8. *Bryobia praetiosa* Koch, female. 1, tip of tarsus I, lateral; 2, lateral view of mite; 3, tip of tarsus, dorsal; 4, anterior front of body; 5, a seta on tibia; 6, dorsum of mite; 7, tip of palpus; 8, a seta on femur.

PLATE VII

1-4. *Bechsteinia californica* new species. 1, dorsal view of mite (numerous leg hairs missing); 2, tip of tarsus; 3, anterior structure on propodosoma, with projecting peritremes; 4, palpus.

5-6. *Cheletogenes ornatus* (Canestrini and Fanzago). 5, gnathosoma, with palpi and associated structures; 6, dorsal view of mite.

7-9. *Eucheyletia mungeri* new species. 7, lateral view of palpus; 8, portions of tibia I and tarsus I; 9, dorsal view of mite.

10-13. *Cheletomimus berlesei* (Oudemans). 10, a dorsal seta; 11, seta on interscutal membrane at hind angle of anterior shield; 12, left palpus, dorsal; 13, dorsal view of mite.

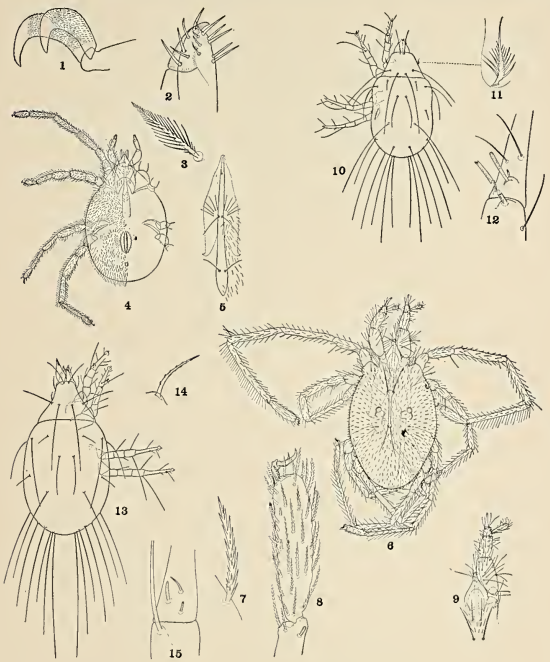

PLATE VIII

1-5. *Balaustium aonidaphagus* (Ebeling). 1, tarsal claws; 2, tips of palp-tibia and palptarsus; 3, a dorsal body seta; 4, ventral view of mite; 5, dorsal region normally including crista, sensillary areas, and sensory setae.

6-9 *Erythraeus* species. 6, dorsal view of mite; 7, a body seta; 8 tarsus I and terminal part of tibia I; 9, hypostome and right palpus, viewed dorsally.

10-12. *Tyrophagus putrescentiae* (Schrank). 10, dorsal view of mite; 11, plumose seta over coxa I; 12, terminal portion of tibia I, and basal portion of tarsus I.

13-15. *Tyrophagus cocciphilus* (Banks). 13, dorsal view of mite; 14, serrate seta over coxa I; 15, apical portion of tibia I, and basal portion of tarsus I.

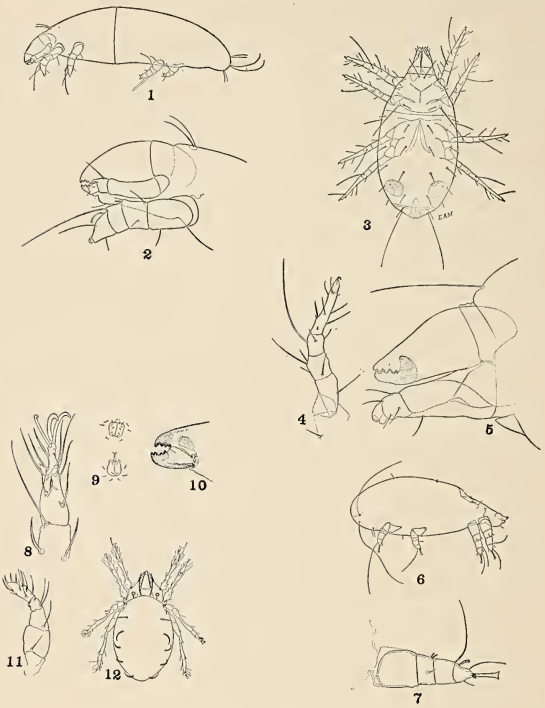

PLATE IX

1-2. *Thyreophagus entomophagus* (Laboulbene). 1, lateral view of mite; 2, anterior portion of mite showing mandibles, palpus, and leg I, lateral.

3-5. *Czenspinskia transversostriata* (Oudemans). 3, dorsal view of mite; 4, leg I; 5, gnathosomal appendages, lateral.

6-7. *Hemisarcoptes malus* (Schimer). 6, lateral view of mite; 7, leg I, lateral view.

8-12. *Humerobates humeralis* Banks. 8, tarsus and distal portion of tibia; 9, ventral plates; 10, mandibles; 11, palpus; 12, dorsal view of mite.

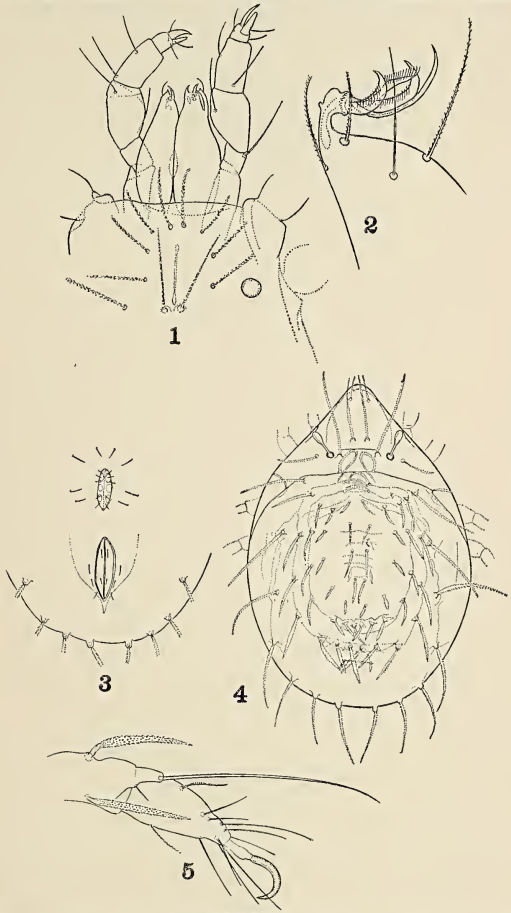

PLATE X

1-2. *Balaustium species*, larva? 1, anterior portion of body showing palpi, chelicerae, and median crista; 2, tip of tarsus I.

3-5. An oribatid. 3, genital and anal plates; 4, dorsal view of mite; 5, tibia I, and tarsus I.

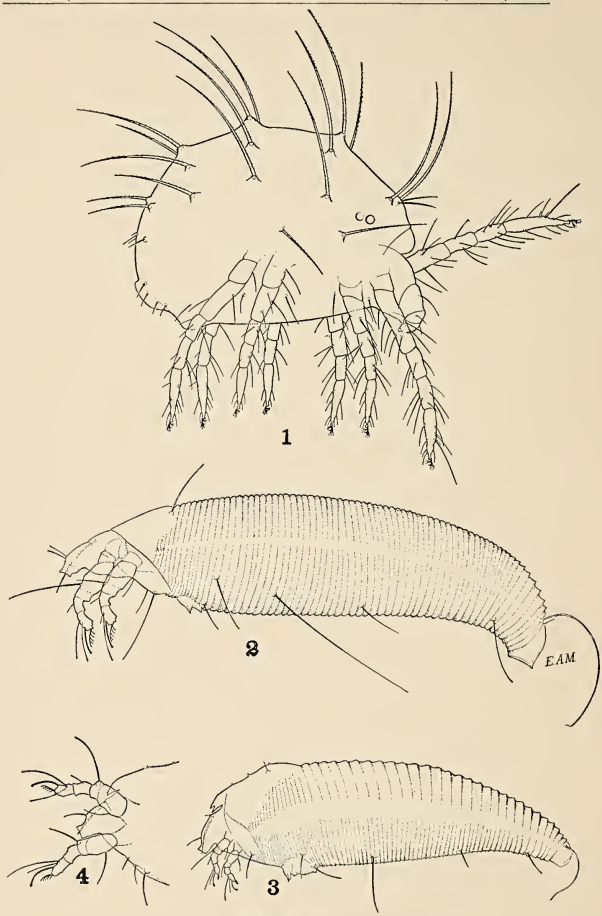

PLATE XI

1. *Metatetranychus citri* (McGregor). Female, lateral view.
2. *Aceria sheldoni* (Ewing). Lateral view of mite.
3-4. *Phyllocoptruta oleivorus* (Ashmead). 3, lateral view of mite; 4, anterior portion of body, more enlarged.

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